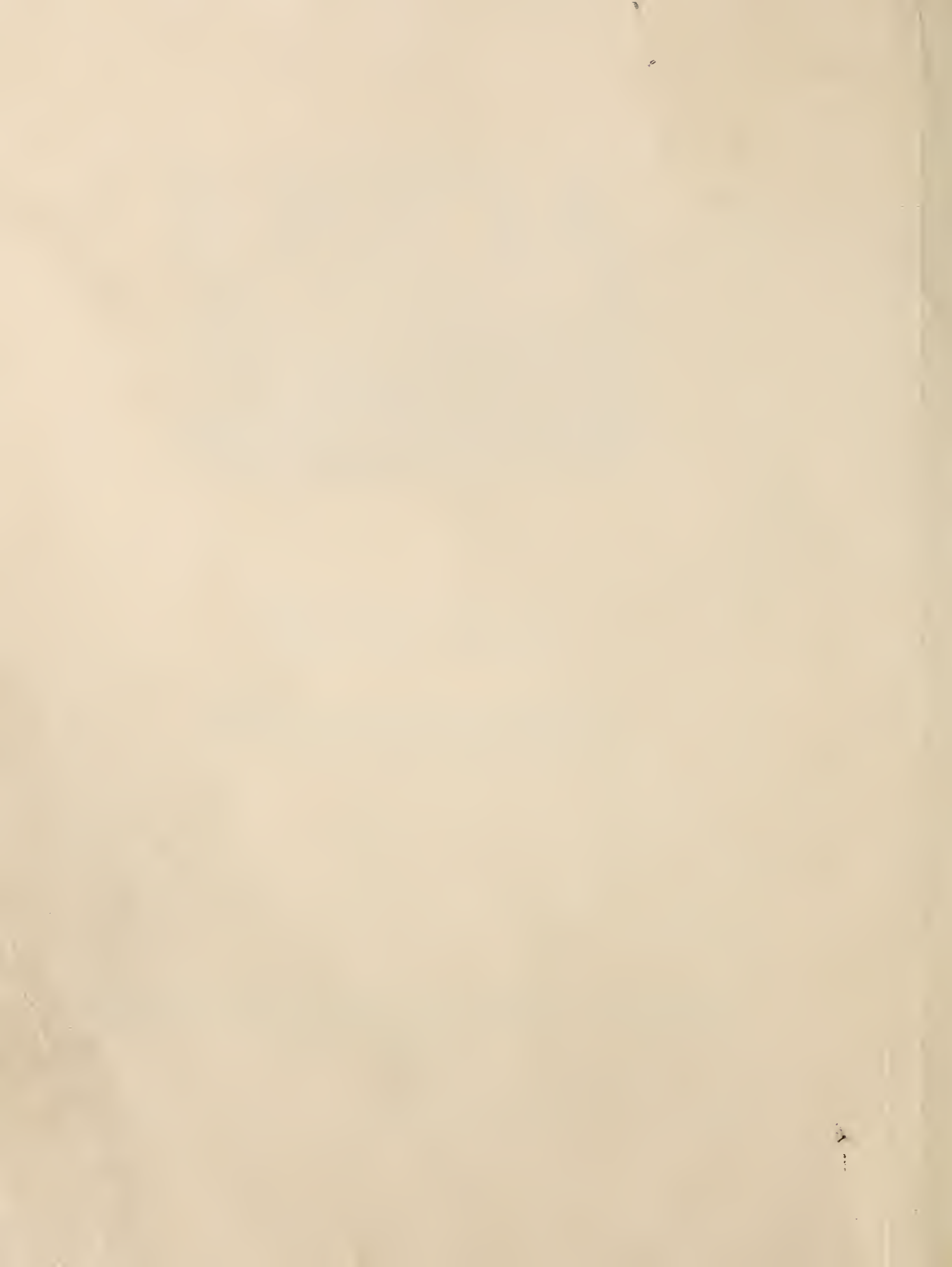


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AGRICULTURAL ECONOMICS RESEARCH



JANUARY 1973 • VOL. 25, NO. 1

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CONTRIBUTORS

TERRY N. BARR is an Agricultural Economist in the Food Consumption and Utilization Section, Economic and Statistical Analysis Division, ERS. HAZEN F. GALE is Head, Food Consumption and Utilization Section, Economic and Statistical Analysis Division, ERS.

RONALD L. MIGHELL is an Agricultural Economist, Farm Production Economics Division, ERS. ELIZABETH LANE is one of the editors of this journal.

HELEN W. JOHNSON is on the Director's staff, Economic Development Division, ERS.

JACK BEN-RUBIN is a Regional Economist, Economic Development Division, ERS.

ROBERT G. DUNBAR, author of many studies on the history of irrigation in the Western States and a long-time cooperator with the Foreign Development Division, ERS, has recently retired from Montana State University.

MICHAEL E. KURTZIG is a Regional Economist, Foreign Demand and Competition Division, ERS.

WILLIAM E. KOST is in the Trade Branch, Foreign Demand and Competition Division, ERS.

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AGRICULTURAL ECONOMICS RESEARCH

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A Quarterly Forecasting Model for the Consumer Price Index for Food

By Terry N. Barr and Hazen F. Gale

A model is developed to forecast the food price component of the consumer price index published by the Bureau of Labor Statistics. The model relates retail food prices to prices received by farmers and to wage rates in food marketing industries. The farm value and farm-retail spread of the market basket are used as intermediate variables in transmitting the effect of these variables to prices of food at home and all food. A system of equations structured along the lines of the USDA market basket is presented along with a set of reduced form forecasting equations.

Key words: Food prices, farm prices, farm-retail spreads, forecasts.

With the recent upsurge of concern over the consumer price index (CPI)—particularly its second largest component, food—the current state of knowledge regarding forecasting and explanation of the CPI for food has come under serious examination. Although some price forecasting models were available, they were not readily adaptable to current operating procedures within the Economic Research Service, which has primary responsibility for food price forecasts.¹ As a result, past forecasts have been largely based on procedures which aggregate the forecasts by individual commodity analysts into an estimate of the price level for all food. These procedures usually reflect changes in the supply situation for the individual commodities but tend to overlook some of the interrelationships among commodities, the influence of demand on marketing charges, and the overall effect of demand on the aggregate food price index. In defense of this approach, it must be recognized that the conceptualization of these latter influences on the CPI for food into a formal statistical model is a reaction to the current problematical situation which has developed.

The objective of the system of equations which we have specified is to utilize readily available forecasts of exogenous variables to generate a series of quarterly forecasts of food-price indexes with a premium placed on speed of computation and accuracy. A completely rigorous theoretical structure was not built into the model, but a system of equations is provided and the short- and long-run impact multipliers are presented. These are useful in determining the combined direct and

indirect effects of changes in the exogenous variables on the endogenous variables.

The basic goal of the model, namely forecasting the retail price index for food given levels of farm prices and marketing costs, is somewhat like going upstream against the traditional current of consumer demand which flows through the marketing system and comes to rest at the farmer's gate as a derived demand. But for a quarterly period, it is the supply curve that shifts and the market prices adjust to clear the market at the farm level. These farm price changes are then passed along to consumers.

After a general outline of the model, we discuss the equations and their roles in the system. An appraisal of the accuracy of the model over a historical period, tests of the model for a recent interval outside the historical period, and forecasts are presented.

General Structure of the Model

The system of equations is closely related to the concept of the USDA market basket.² The retail value of this basket of farm foods is composed of a farm value which measures the payment to farmers for the raw materials equivalent to the food purchased by consumers, and a farm-retail spread which closely approximates costs of assembling, processing, transporting, and distributing the farm food products. The market basket is made up of a constant quantity of different foods, so the variations in the retail cost, farm value, and farm-retail spread are essentially price variations. Care is taken to assure consistency between retail and farm

¹For example, see: Jimmy L. Matthews. Forecasting the Quarterly Retail Food Price Index. Natl. Food Situation, May 1967.

²See: Forrest E. Scott and Henry T. Badger. Farm-Retail Spreads for Food Products. U.S. Dept. Agr., Misc. Pub. 741, Jan. 1972.

levels so that differential movements accurately measure changes in the spread between retail and farm prices. Because of these adjustments, the changes in the farm value of the market basket which are more relevant for our forecasts of retail food prices often differ from changes in USDA's Index of Prices Received by Farmers. The latter also includes nonfood commodities, such as cotton, tobacco, and feed grains.

The model is a quasi-recursive system structured along the lines of the market basket, with the indexes of prices received by farmers for various farm products used to estimate the farm values of the crop and livestock food groups. These estimates are then combined with other equations which estimate the farm-retail spreads for the groups, to estimate the food-at-home component of the consumer price index. Finally, the all-food index, which includes food eaten away from home, is estimated.

The treatment of the crop and livestock components is not entirely symmetric (fig. 1). The recursive aspects of the model which are evident for crop foods are absent in the livestock subsector, where some feedback from the consumer market to the farm level for livestock products is found.

There is an implicit consumer market for crop foods consumed at home which provides the setting for price determination in the food crops subsector. Within this general environment, the farm value of crops and the farm-retail spread are determined simultaneously in the system but without any direct link to the general level of food prices. Once the farm value and farm retail spread are determined, they are fed recursively into the mechanism for estimating the CPI for food at home.

For livestock food products, there is again an implicit market environment, but this time a direct link exists between the farm value and the food-at-home price level. As a result, the farm value and the farm-retail spread for livestock products are estimated simultaneously in the system along with the total food-at-home index.

The difference in structure for the two product groups has no strong theoretical basis.³ It is based mainly on the statistical results supported by the data. Certain characteristics of the market for each group are examined later as possible explanations of this difference in price-determining influences.

The System of Structural Equations

The following equations were estimated by two-stage least squares (TSLS), utilizing quarterly data from the

first quarter of 1960 to the third quarter of 1971. The numbers in parentheses are *t* values; *D.W.* is the Durbin-Watson statistic.

1. Farm value of crop foods:

$$\begin{aligned} FVC_t = & 49.7960 + 0.4644 FRSC_t \\ & (-0.09) \quad (2.32) \\ & - 0.0266 FRSC_{t-1} - 0.3596 FRSC_{t-2} \\ & (-1.52) \\ & + 0.0964 PRO_t + 0.1155 PRF_t \\ & (2.04) \quad (4.46) \\ & + 0.2696 PRV_t - 7.3816 DWS_t \\ & (6.03) \quad (-7.16) \\ & - 4.9629 DWA_t \\ & (-5.19) \end{aligned}$$

$$R^2 = 0.924 \quad D.W. = 1.25$$

2. Farm-retail price spread for crop foods:

$$\begin{aligned} FRSC_t = & 63.9108 - 0.1442 FVC_t \\ & (-3.25) \\ & + 0.0718 FVC_{t-1} - 0.1150 FVC_{t-2} \\ & (1.39) \quad (-2.48) \\ & - 0.0104 FVC_{t-3} + 0.5570 WFMI_t \\ & (-1.00) \quad (27.70) \\ & + 1.3053 DSQ_t + 2.2857 DTQ_t \\ & (2.99) \quad (5.42) \end{aligned}$$

$$R^2 = 0.984 \quad D.W. = 1.440$$

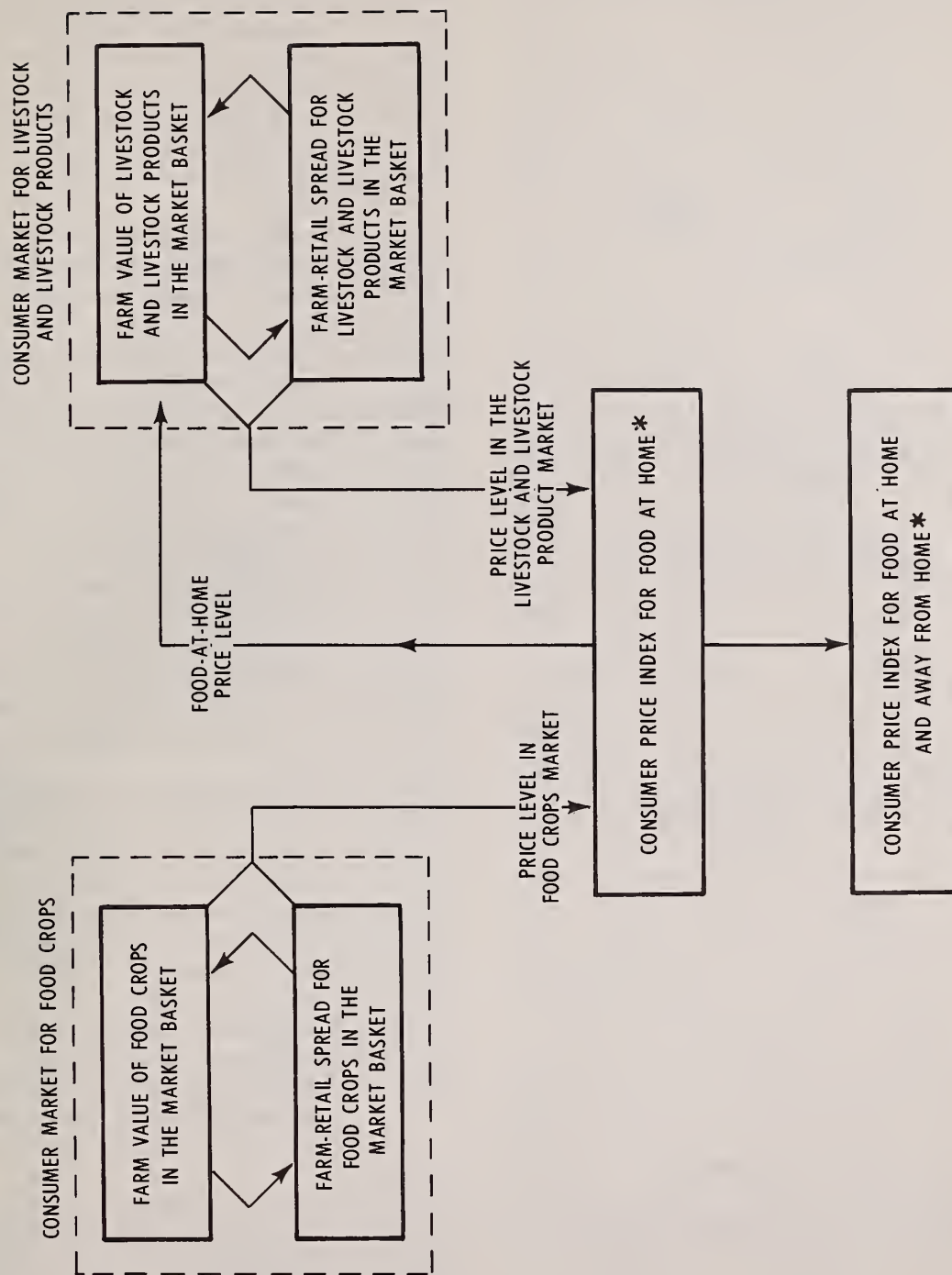
3. Farm value of livestock food products:

$$\begin{aligned} FVL_t = & 17.1637 - 0.3966 FRSL_t \\ & (-5.13) \\ & + 0.2335 CPIF_t + 0.6115 PRM_t \\ & (2.15) \quad (18.74) \\ & + 0.2346 PRD_t + 0.1528 PRP_t \\ & (6.75) \quad (8.72) \\ & - 0.9064 DFQ_t \\ & (2.52) \end{aligned}$$

$$R^2 = 0.991 \quad D.W. = 1.203$$

³The term "structure" is used to differentiate this set of equations from the "reduced forms" later in the article.

DETERMINATION OF FOOD PRICES



* Bureau of Labor Statistics

Figure 1

4. Farm-retail price spread for livestock food products:

$$\begin{aligned}
 FRSL_t = & 14.5147 - 0.3685 FVL_t \\
 & (-6.40) \\
 & + 0.2357 FVL_{t-1} + 0.2042 FVL_{t-2} \\
 & (3.71) \quad (3.84) \\
 & + 0.9299 WFM_{t-1} - 0.4690 T_t \\
 & (13.19) \quad (-6.55) \\
 & + 1.9842 D4Q_t \\
 & (3.31) \\
 R^2 = & 0.969 \quad D.W. = 2.045
 \end{aligned}$$

5. Consumer price index for food consumed at home:

$$\begin{aligned}
 CPIF_t = & 3.40227 + 0.2253 FVL_t + 0.1535 FVC_t \\
 & (20.05) \quad (7.08) \\
 & + 0.3656 FRSL_t + 0.2758 FRSC_t \\
 & (10.96) \quad (6.06) \\
 & + 0.0545 T_t \\
 & (2.83) \\
 R^2 = & 0.997 \quad D.W. = 1.441
 \end{aligned}$$

6. Consumer price index for all food:⁴

$$\begin{aligned}
 TCPIF_t = & -9.05481 + 1.08233 CPIF_t \\
 & (46.42) \\
 & + 0.02202 T_t \\
 & (1.49) \\
 R^2 = & 0.998 \quad D.W. = 0.768 \\
 CPIF_t^* = & CPIF_t - 0.9592 CPIF_{t-1} \\
 T_t^* = & T_t - 0.9592 T_{t-1} \\
 TCPIF_t^* = & TCPIF_t - 0.9592 TCPIF_{t-1} \\
 TCPIF_t^* = & 0.2913 + 0.7804 CPIF_t^* + 0.4047 T_t^* \\
 & (33.81) \quad (8.33) \\
 R^2 = & 0.9998 \quad D.W. = 2.159
 \end{aligned}$$

⁴This set of equations reflects the first order autoregressive adjustments necessary to correct for serial correlation bias which was evident in the first specifications of the all food index presented above. 0.9592 is the estimate of b in $U_t = bU_{t-1}$ where U_t and U_{t-1} are the observed residuals in the first equation.

Definition of variables:

- FVL_t = Farm value of livestock food products, market basket, index (1967 = 100).⁵
- FVC_t = Farm value of crop food products, index.
- $FRSL_t$ = Farm-retail spread for livestock food products, index. Difference between the retail cost and farm value.
- $FRSC_t$ = Farm-retail spread for food crop products, index.
- $CPIF_t$ = Consumer price index for food at home (Bureau of Labor Statistics series).
- $CPIF_t^*$ = Adjusted consumer price index, food at home.
- $TCPIF_t$ = Consumer price index for all food (Bureau of Labor Statistics series).
- $TCPIF_t^*$ = Adjusted consumer price index for all food.
- PRM_t = Prices received by farmers for meat animals (Statistical Reporting Service series), index.⁶
- PRD_t = Prices received by farmers for dairy products, index.
- PRP_t = Prices received by farmers for poultry and eggs, index.
- PRO_t = Prices received by farmers for oil products, index.
- PRF_t = Prices received by farmers for fruits, index.
- PRV_t = Prices received by farmers for vegetables, index.
- DFQ_t = Dummy variable, value of one for the first quarter.
- DSQ_t = Dummy variable, value of one for the second quarter.
- DTQ_t = Dummy variable, value of one for the third quarter.
- $D4Q_t$ = Dummy variable, value of one for the fourth quarter.
- DWS_t = Dummy variable, value of one for the years of wheat subsidies, 1960-64.
- DWA_t = Dummy variable, value of one for the years of high effective national wheat allotments, 1967-68.

⁵This farm value is calculated by multiplying the price the farmer receives for the corresponding farm product by the quantity of a farm product equivalent to one unit of product at retail. The current market basket contains the average quantities of domestic farm-originated foods purchased annually per household in 1960-61 for preparation at home by families of urban wage earners and clerical workers and workers living alone. All indexes are on a base of 1967 = 100. They are published quarterly in the Marketing and Transportation Situation.

⁶Current data are published in Agricultural Prices, by USDA's Statistical Reporting Service. Indexes on a 1910-14 base were converted to 1967 reference base. See Agricultural Prices, Sup. 2, June 1970, for conversion factors.

$WFM I_t$ = Hourly wages in the food marketing industry, index.⁷

T_t = Time trend variable with $T = 1$ in first quarter 1960.

Lagged variables are identified by a subscript $t-i$ which means the variable has been lagged i quarters. Symbols for lagged variables are the same as for current variables defined above.

Crop foods. The crop foods system is a system which feeds a price level for food crops into the retail market but receives no direct price level feedback from that market, apparently relying almost totally on cost factors for spread determination and feedback. This result, although not completely consistent with the theory of derived demand, does reflect the nature of the market. While the farm value of crop foods constitutes only about 20 percent of the total farm value in the market basket, the farm-retail spread for crop foods constitutes about 50 percent of the total spread in the market basket. In addition the farm-retail spread accounted for almost 80 percent of the total retail value of crop foods in the market basket.⁸ Thus the key element in this system is the farm-retail spread, which is basically a measure of cost plus profit. Changes in farm-retail spreads in the long run are determined mainly by changes in costs of all factors involved in processing and distribution.

The coefficients on the indexes of prices received by farmers for oil crops, fruit, and commercial vegetables appear to be roughly in line with their respective importance in the market basket. The farm price of grain does not appear explicitly because it was not a statistically significant variable. However, dummy variables, DWS_t and DWA_t , were included. These are designed to identify significant changes in grain programs which affected price. In particular, DWS_t identifies the period 1960-64 for which wheat subsidy programs were in effect, while DWA_t identifies the periods of abnormally high effective wheat allotments in 1967-68.

The farm-retail spread equation reflects the cost concept of the spread as well as the lagged adjustment with respect to the farm value. But in this equation a rise in the farm value initially depresses the farm-retail spread contrary to the relationship found in the farm value equation. This negative relationship may be explained in terms of the imperfections of the market in adjusting to short-term changes. The negative relationships for the lagged farm value represent the other side

of the derived-demand coin; now the increase in the price of the raw farm product depresses the relative price of the other input, namely marketing services.

Labor costs in marketing are reflected in the wages variable, $WFM I_t$, which is a weighted average of wages in the (1) manufacturing, (2) wholesaling, and (3) retailing phases of the food industry.⁹ Since wage levels in food marketing move closely with wages in the rest of the economy, this variable may also provide a link with the price and cost levels outside the food sector. The current wage level was highly significant in this equation, the only equation in which it was important. In other equations, the lagged wage was the key element. This may be partly explained by the nature of the crop products group. Bakery and cereal products have a more extensive process of manufacturing and a higher labor cost component than most food products. Additionally, labor costs make up a substantial portion of retail and wholesale gross margins for fresh fruits and vegetables. Thus it is not surprising that fresh and processed fruits and vegetables, which have the largest total farm-retail spread of any group of products in the market basket, should dictate a major role for labor costs in determining the farm-retail spread.

The dummy variables in the spread equation for crop foods play an important role. Earlier studies had indicated that the spread and farm value of the crop foods moved very much together, whereas the farm value and spread equations presented here are not completely in agreement. The correlation between the two components apparently is a second- and third-quarter seasonality phenomenon inherent in the crop foods system. The seasonal rise in the spread can be partly attributed to seasonally short supplies, greater transportation costs for fresh produce, and accumulated storage costs for some items during those periods.

Livestock food products. The system for livestock food products reflects very different relationships to the total food market. The key is the importance of this product group in the total farm food sector. About 80 percent of the total farm value of the market basket is attributed to livestock products. At the same time, livestock products represent about 50 percent of the total market basket farm-retail spread. This system, in contrast to the crop food system, is certainly not as strongly oriented to marketing costs. Since the farm value of livestock foods accounts for 80 percent of the total farm value, it was expected that any feedback from the total retail level to the farm level would be likely to show up in the livestock sector.

⁷See Marketing and Transportation Situation, July 1972, p. 2.

⁸These figures are based on 1967 market basket information.

⁹See page 13 of reference cited in footnote 1.

The farm value equation provides the key link between the food price index and the livestock products group. Since food prices tend to be closely related to the general price level, this variable also reflects the general demand conditions in the economy. The coefficients on the indexes of prices received for meat animals, dairy products, and poultry and eggs are roughly consistent with their importance in the farm value of the market basket. This equation is much more completely specified than the farm value equation for crops, because farm price indexes are available for each of the major categories. In addition, the farm-retail spreads are not so dominant.

The lag structure of the farm value in the farm-retail spread reflects the speed with which increases in farm value, which tend to reduce spreads, are recovered. The lags are shorter in this system than in the crop foods sector, due to the much more limited storability of the product group. Although the spread acts as a buffer for a portion of the increases in the farm value, it is short-lived and the old level of farm-retail spread is soon restored and even expanded. Wages in the food marketing industry lagged one quarter are of significant importance to the farm-retail spread in the current quarter. The omission of current wages is somewhat surprising but it is not inconsistent with the asserted behavior of packers to temporarily hold the line on small increases in the spread for competitive reasons. The time trend variable reflects the cost savings due to technology which have a depressing effect upon the retail spread.

Consumer price index for food at home. This equation is essentially an adding-up procedure, since by definition the total farm value plus the total farm-retail spread should equal the retail cost. However, the Bureau

of Labor Statistics (BLS) consumer price index for food at home includes fish, coffee, and other miscellaneous foods as well as the foods in the USDA market basket. The relative weights of the farm value and spreads of each of the product groups in the retail cost of the market basket and in the BLS consumer price index for food at home, along with the corresponding regression coefficients, are shown in table 1. This table shows that the retail price equation is not an identity but it is closely related to the market basket system.

Consumer price index for all food. This equation is exogenous to the system but designed to be recursively determined by the system. Initial attempts to relate the index to food at home resulted in very low Durbin-Watson statistics, indicating potential first order positive autocorrelation. Utilizing the Cochrane-Orcutt iterative technique for first order schemes, the *TCPIF** equation was obtained.¹⁰ The acceptance of this equation was not wholly based upon the very acceptable R^2 and t values which were obtained in the adjusted equation. The validity of the equation was reinforced by comparison of the coefficient of the consumer price index for food at home in the equation with its actual relative importance in the all-food price index. The actual weight in 1967 was 0.788 while the regression coefficient is 0.780. The balance of the index (0.220) relates to food eaten away from home. The time trend remains significant in explaining the continued uptrend in food costs.

¹⁰D. Cochrane and G. H. Orcutt. Application of Least-Squares Regressions to Relationships Containing Auto-Correlated Error Terms. Jour. Amer. Statis. Assoc., Vol. 44, pp. 32-61, 1949.

Table 1.—Food price composition: Relative weights for farm value and farm-retail spread by major product group, 1967

Item	Weights in retail cost, market basket	Weights in BLS food-at-home index	Regression coefficients food-at-home equation
Livestock food products:			
Farm value	0.29207		0.2253
Farm-retail spread	0.26103		0.3656
Total	0.55310	0.515	0.5909
Crop foods:			
Farm value	0.08886		0.1535
Farm-retail spread	0.31183		0.2758
Total	0.40069	0.413	0.4293
Total livestock and crops	¹ 0.95379	² 0.928	1.0202

¹ The balance of the retail cost is due to miscellaneous products.

² The balance of the CPI is composed of sweeteners, beverages, and miscellaneous products.

Appraisal of the Model Over the Historical Period, 1960-71

The appraisal of the model for 1960-71 was based on estimates generated by using a Gauss-Seidel numerical technique.¹¹ This technique yields results equivalent to the reduced form estimates when dealing with a linear system. However, the major advantage is its greater flexibility in providing solutions for a nonlinear system of reduced form equations when it is difficult to derive the reduced form coefficients from the structural coefficients. In addition, it is readily adaptable to changes in the equations within the system. Actual values for all variables were provided to the equation system for the fourth quarter of 1959, and earlier if required for the lag structure. Actual values for 1960-71 were provided only for exogenous and lagged exogenous variables. The system generated the values of the endogenous variables for 1960-71. The statistics and graphs presented are the results generated for the historical period covering 47 quarters.

Variances. In table 2, two sets of variances and standard deviations for each of the dependent variables indicate the amount of variability in the estimates. The first set of variances measures the variability of the point estimate from the actual indexes and reflects how well the model forecasts actual values for each variable. The second set of variances reflects how well the model forecasts the percentage changes from one quarter to the next. Although these variances are not completely independent, they do reflect the accuracy of the forecasts using different objectives.

In general, the variances are relatively small; those for farm value of crop foods and farm-retail spread for live-stock products were the largest. The latter variables were two of the most volatile series and acceptable structural

¹¹For a discussion of the Gauss-Seidel method for linear systems, see: V. N. Faddeeva. *Computational Methods of Linear Algebra*. Dover, pp. 131-143, 1959. Translated by C. D. Benstev.

equations for them were difficult to estimate. The variances on the final two key equations are very small.

Graphs. Visual evidence of the goodness of fit over the historical period is contained in the graphs illustrating actual values and estimates generated by the model (figs. 2-7). As the previous statistics indicated, all the fits are good. The widest variations occur in the equations having the dependent variables with the largest variances and standard deviations.

Appraisal of the Model as an Aid in Forecasting

This model is not designed to be an entity unto itself whose forecasts are sacred. It is a supportive tool which should be used with other information, with the realization that the forecasts generated by the model are only as good as the forecasts of the exogenous variables that are provided. Prediction interval tests—tests of the predictive accuracy of the model for a period outside that on which the model is based—illustrate this point.

One of the objectives of this study was to provide a model which could be utilized both conveniently and rapidly with the least confusion. Toward this end, the above set of equations has been transformed into the reduced form equivalent. With the variables defined as in the "structural" system, the reduced form system and the autoregressive equation are presented below.

$$\begin{aligned} FVC_t = & 74.48797 + 0.09035 PRO_t + 0.10825 PRF_t \\ & + 0.25268 PRV_t + 0.56814 DSQ_t \\ & + 0.99486 DTQ_t - 6.91831 DWS_t \\ & - 4.65141 DWA_t + 0.24244 WFMI_t \\ & + 0.03125 FVC_{t-1} - 0.05005 FVC_{t-2} \\ & - 0.00453 FVC_{t-3} - 0.02493 FRSC_{t-1} \\ & - 0.33703 FRSC_{t-2} \end{aligned}$$

Table 2.—Variances of the fitted model

Variable	Variances		Standard deviations	
	Point estimates (indexes)	Percentage change estimates	Point estimates (indexes)	Percentage change estimates
Farm value:				
Livestock food products	1.192	1.598	1.092	1.264
Crop foods	3.502	4.139	1.871	2.034
Farm-retail spreads:				
Livestock food products	2.619	6.376	1.618	2.525
Crop foods	0.722	1.106	0.850	1.052
CPI for food at home	0.389	0.508	0.623	0.713
CPI for all food	0.548	0.308	0.740	0.555

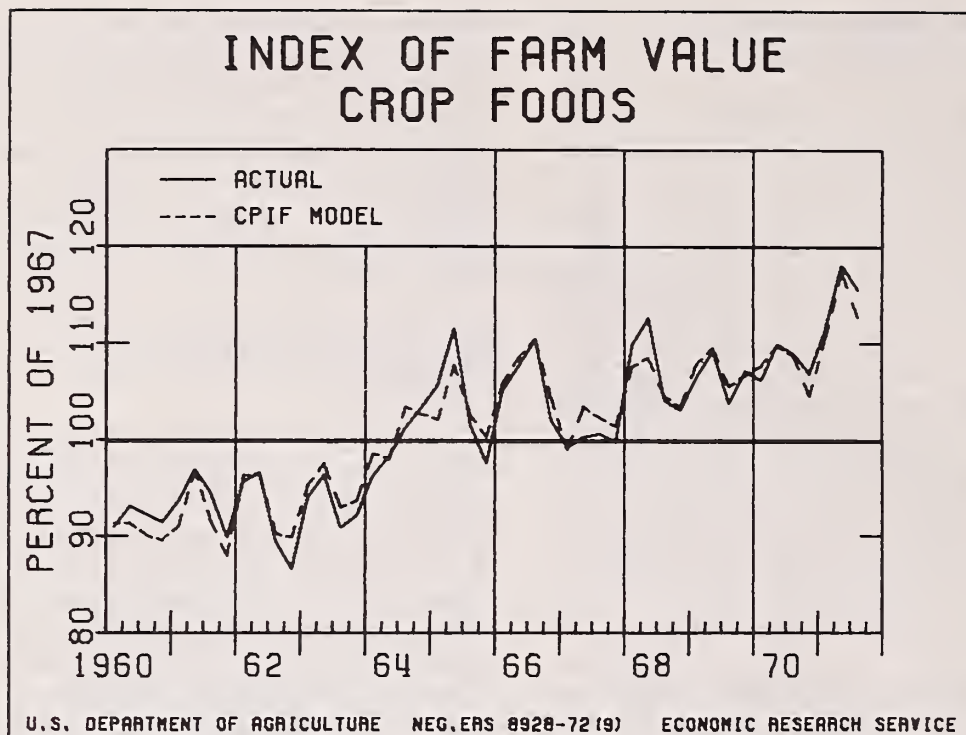


Figure 2

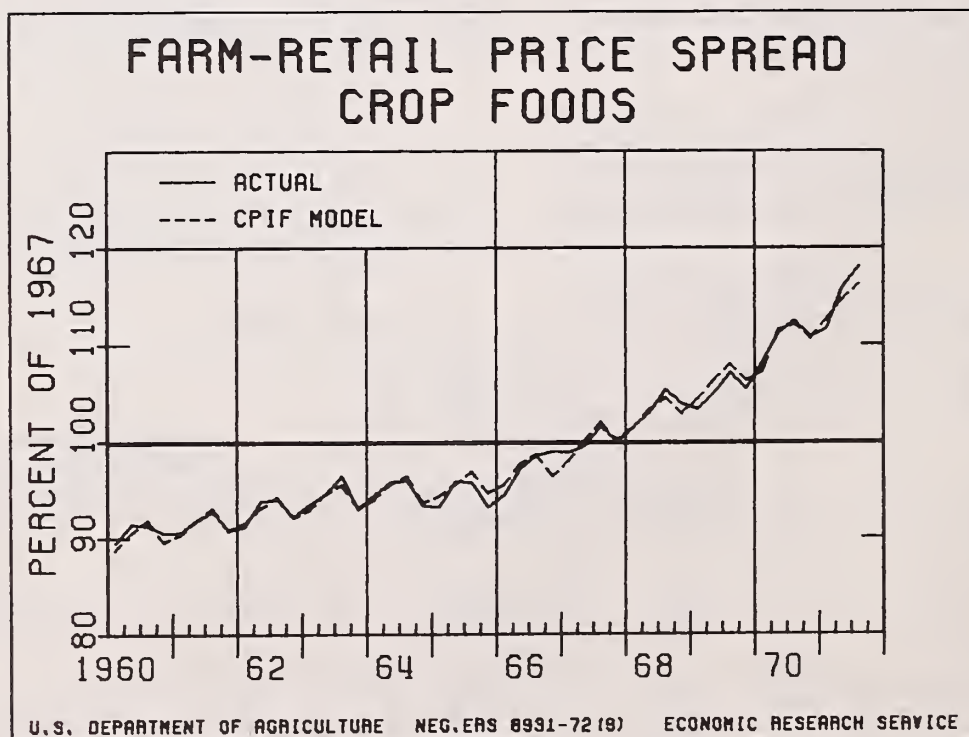


Figure 3

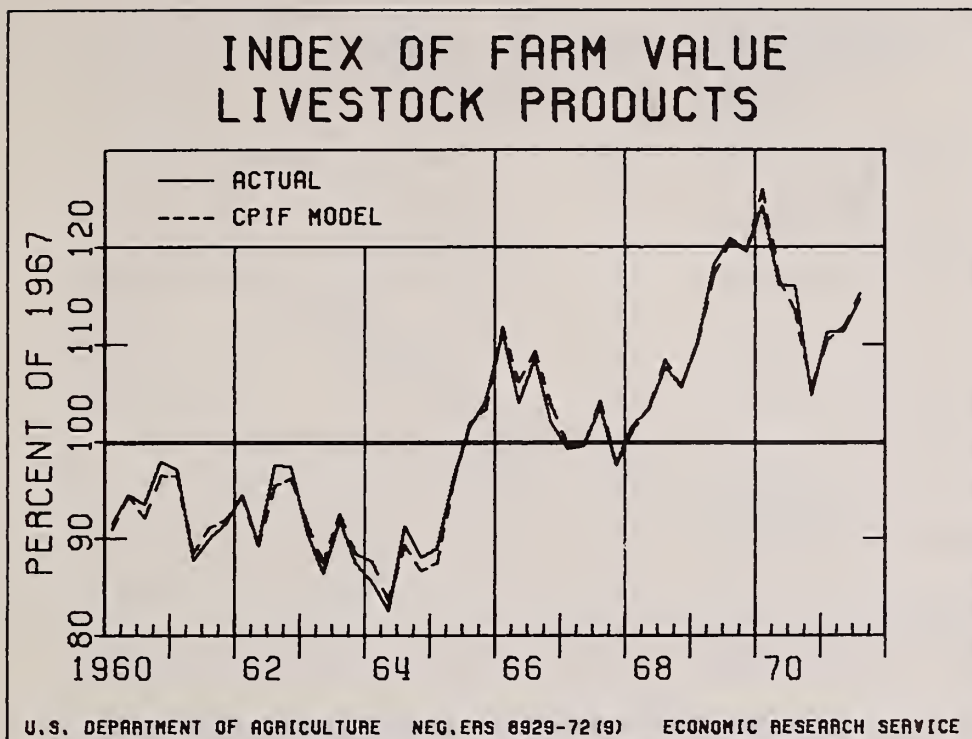


Figure 4

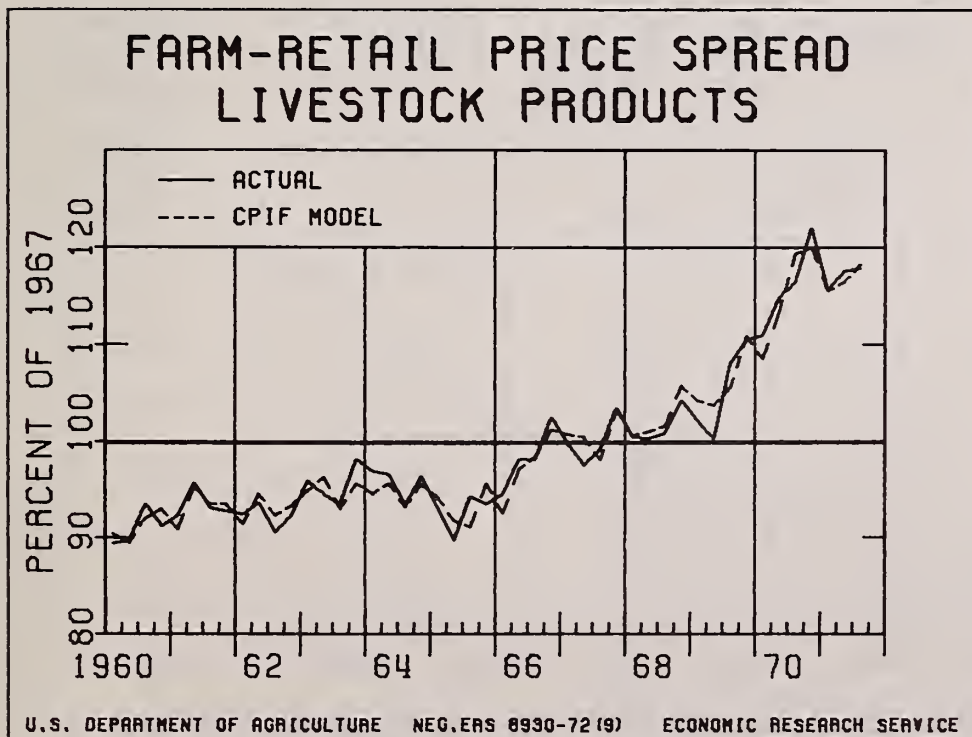


Figure 5

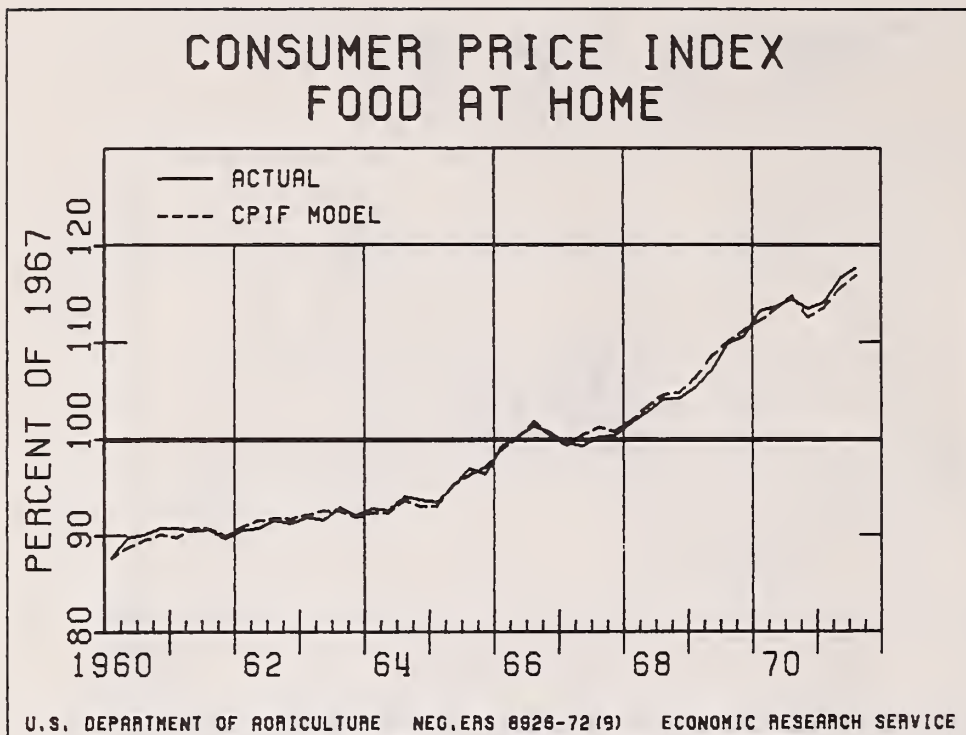


Figure 6

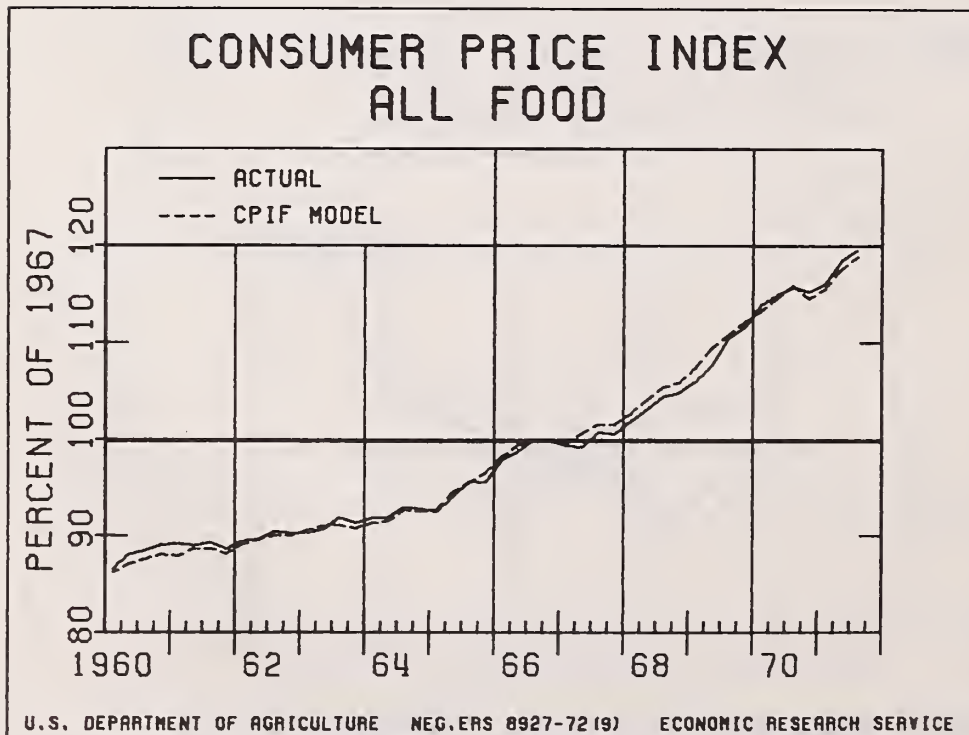


Figure 7

$$\begin{aligned}
FRSC_t = & 53.16963 - 0.01303 PRO_t - 0.01561 PRF_t \\
& - 0.03644 PRV_t + 1.22337 DSQ_t \\
& + 2.14224 DTQ_t + 0.99762 DWS_t \\
& + 0.67073 DWA_t + 0.52204 WFMI_t \\
& + 0.06729 FVC_{t-1} - 0.10778 FVC_{t-2} \\
& - 0.00975 FVC_{t-3} + 0.00359 FRSC_{t-1} \\
& + 0.04860 FRSC_{t-2}
\end{aligned}$$

$$\begin{aligned}
FVL_t = & 21.35997 + 0.73436 PRM_t + 0.28173 PRD_t \\
& + 0.18350 PRP_t + 0.00288 PRO_t \\
& + 0.00345 PRF_t + 0.00806 PRV_t \\
& - 1.08850 DFQ_t + 0.11907 DSQ_t \\
& + 0.20850 DTQ_t - 0.22063 DWS_t \\
& - 0.14834 DWA_t + 0.05081 WFMI_t \\
& - 0.74162 D4Q_t + 0.19058 T_t \\
& - 0.08810 FVL_{t-1} - 0.07632 FVL_{t-2} \\
& + 0.00655 FVC_{t-1} - 0.01049 FVC_{t-2} \\
& - 0.00095 FVC_{t-2} - 0.00080 FRSC_{t-1} \\
& - 0.01075 FRSC_{t-2} - 0.34756 WFMI_{t-1}
\end{aligned}$$

$$\begin{aligned}
FRSL_t = & 6.64355 - 0.27061 PRM_t - 0.10382 PRD_t \\
& - 0.06762 PRP_t - 0.00106 PRO_t \\
& - 0.00127 PRF_t - 0.00297 PRV_t \\
& + 0.40111 DFQ_t - 0.04388 DSQ_t \\
& - 0.07683 DTQ_t + 0.08130 DWS_t \\
& + 0.05466 DWA_t - 0.01872 WFMI_t \\
& + 2.25749 D4Q_t - 0.53923 T_t \\
& + 0.26816 FVL_{t-1} + 0.23232 FVL_{t-2} \\
& - 0.00241 FVC_{t-1} + 0.00387 FVC_{t-2}
\end{aligned}$$

$$\begin{aligned}
& + 0.00035 FVC_{t-3} + 0.00029 FRSC_{t-1} \\
& + 0.00396 FRSC_{t-2} + 1.05798 WFMI_{t-1} \\
CPIF_t = & 29.25527 + 0.06652 PRM_t + 0.02552 PRD_t \\
& + 0.01662 PRP_t + 0.01054 PRO_t \\
& + 0.01262 PRF_t + 0.02947 PRV_t \\
& - 0.09859 DFQ_t + 0.43540 DSQ_t \\
& + 0.76243 DTQ_t - 0.80680 DWS_t \\
& - 0.54244 DWA_t + 0.18579 WFMI_t \\
& + 0.65825 D4Q_t - 0.09970 T_t \\
& + 0.07819 FVL_{t-1} + 0.06774 FVL_{t-2} \\
& + 0.02395 FVC_{t-1} + 0.03836 FVC_{t-2} \\
& - 0.00347 FVC_{t-3} - 0.00291 FRSC_{t-1} \\
& - 0.03930 FRSC_{t-2} + 0.30849 WFMI_{t-1}
\end{aligned}$$

$$TCPIF_t^* = 0.2913 + 0.7804 CPIF_t^* + 0.4047 T_t^*$$

This system, when provided with forecasts of the respective indexes of prices received by farmers and the wage rate in the food marketing industry, will yield forecasts of the endogenous variables through direct substitution. The input forecasts are typically provided by the commodity specialists. The system is currently utilized on the remote access terminal (RAX) and has a running time of 10 minutes to provide forecasts covering four quarters. The results are equivalent to the Gauss-Seidel solution since the system is composed of linear equations. The interchange of techniques—reduced form and Gauss-Seidel—should not be interpreted as anything but a preference for convenience on the part of the authors and users of the program.

Prediction-interval tests. The prediction-interval test, based on the third quarter of 1971 as a starting point, is conducted for the fourth quarter of 1971 and the first and second quarters of 1972 using a full model solution, and using the estimated lagged endogenous variables in one period as input into the model for later periods. Actual and predicted point estimates and percentage changes were compared (table 3). The variances of the CPI for food at home and all food indicate relatively good prediction-interval results in spite of near-record increases in meat prices and wages in food marketing

Table 3.—Prediction-interval test

Item	1971 IV		1972 I		1972 II		Standard deviation
	Actual	Prediction	Actual	Prediction	Actual	Prediction	
Point predictions:	<i>Index (1967 = 100)</i>						
Farm value:							
FVL	115.1	116.6	124.0	126.0	124.4	124.6	1.448
FVC	116.5	113.8	113.7	112.2	115.0	116.7	2.035
Farm-retail spread:							
FRSL	117.5	121.1	118.6	117.5	118.1	124.8	4.437
FRSC	115.3	113.8	117.1	117.0	117.2	118.2	1.042
CPI for food at home	117.2	116.8	119.8	118.2	120.5	121.6	1.144
CPI for all food	119.4	119.2	121.6	120.7	122.6	123.7	0.829
Percentage change predictions:	<i>Percent</i>						
Farm value:							
FVL	0.392	1.653	7.658	8.031	0.323	-1.075	1.108
FVC	0.971	-1.429	-2.428	-1.397	1.143	3.983	2.062
Farm-retail spread:							
FRSL	0.339	2.684	0.936	-3.020	-0.522	6.321	4.760
FRSC	-2.270	-3.620	1.508	2.827	0.085	1.031	1.219
CPI for food at home	0.424	-3.620	2.303	1.232	0.584	2.875	1.356
CPI for all food	-0.167	-0.334	1.842	1.258	0.822	2.486	0.905

Table 4.—Short-run impacts of quarterly changes

Exogenous variable	Magnitude of change	Short-run impacts on endogenous variables expressed as changes in index (1967 = 100)					
		<i>FVL</i>	<i>FVC</i>	<i>FRSL</i>	<i>FRSC</i>	<i>CPIF</i> at home	<i>CPIF</i> all food
Index of prices received for meat animals	1 index point or						
Cattle	\$0.386/cwt.	0.7344	0	-0.2706	0	0.0665	0.0519
Hogs	\$0.646/cwt.						
Index of prices received for dairy products	1 index point or						
Milk (wholesale)	\$0.054/cwt.	0.2817	0	-0.1038	0	0.0255	0.0199
Index of prices received for poultry and eggs	1 index point or						
Eggs	\$0.005/doz.	0.1835	0	-0.0676	0	0.0166	0.0129
Broilers	\$0.006/pound						
Index of prices received for fruit	1 index point or						
Apples	\$0.002/pound	0.0034	0.1082	-0.0013	-0.0156	0.0126	0.0098
Index of prices received for vegetables	1 index point or						
Tomatoes	\$0.152/ton	0.0081	0.2527	-0.0030	-0.0364	0.0295	0.0230
Index of wages in food marketing industries	1 index point or						
Change in hourly wage	\$0.025/hour	0.0508	0.2424	-0.0187	0.5220	0.1858	0.1450

industries compared with the historical period of the model. The somewhat atypical wage increases are attributable to deferred pay raises. The remainder of the variances are in line with the pattern shown by the tests of the fitted model over the historical period.

Although 1971-72 is not a very satisfactory period for testing the model because of market distortions caused by the wage-price control program imposed on August 15, 1971, the higher estimates in the spread and food price equations generated by the model tend to be consistent with the consensus that prices were held down to some extent by controls.

Impact multipliers. The one-quarter, or short-run, impacts of the changes in the exogenous variables on the endogenous variables are shown in table 4. All changes are related to a unit change in the exogenous variables which are in the form of indexes. Examples of individual price changes necessary to achieve these unit changes in the indexes are provided and are based on SRS weights used in combining the prices to obtain the indexes. The

most significant variables with regard to the consumer price index for food are prices received by farmers for meat animals and wages in the food marketing industry. For example, an increase of 39 cents per 100 pounds of beef cattle causes an increase of 0.0719 in the consumer price index for food at home. An increase of 65 cents per 100 pounds in hogs yields the same result. Wages in the food industry have an immediate impact of 0.2053 for every increase of 2½ cents per hour.

The long-run impacts in table 5 show the amount by which the endogenous variables will be raised for a unit change in the index after the change has worked completely through the system. For example, if the index of prices received for meat rose one unit and remained at the new level, there would be a short-run impact of 0.0719 on the CPI for food at home. In the next quarter, the lagged farm value for livestock will influence the spread and also the CPI for food at home and the farm value for livestock. This process continues until the levels of the endogenous variables are con-

Table 5.—Long-run impacts

Exogenous variable	Magnitude of change	Long-run impacts on endogenous variables expressed as changes in index (1967 = 100)					
		<i>FVL</i>	<i>FVC</i>	<i>FRSL</i>	<i>FRSC</i>	<i>CPIF</i> at home	<i>CPIF</i> at home and away
Index of prices received for meat animals	1 index point or						
Cattle	\$0.386/cwt.	0.6317	0	0.0419	0	0.1576	0.1230
Hogs	\$0.646/cwt.						
Index of prices received for dairy products	1 index point or						
Milk (wholesale)	\$0.054/cwt.	0.2423	0	0.0160	0	0.0605	0.0472
Index of prices received for poultry and eggs	1 index point or						
Eggs	\$0.005/doz.	0.1578	0	0.0105	0	0.0394	0.0307
Broilers	\$0.006/pound						
Index of prices received for fruit	1 index point or						
Apples	\$0.002/pound	0.0027	0.1130	0.0001	-0.0225	0.0118	0.0092
Index of prices received for vegetables	1 index point or						
Tomatoes	\$0.152/ton	0.0063	0.2638	0.0003	-0.0525	0.0275	0.0215
Index of wages in food marketing industries	1 index point or						
Change in hourly wage	\$0.025/hour	-0.2593	0.0452	0.9073	0.5450	0.4305	0.3359

sistent with the new farm price level. The long-run effect is the difference between the level before the increase and that after the increase. Although the endogenous variable for the farm-retail spread for livestock food declines in the first round, after four quarters it increases to a spread level consistent with the new farm price. In general, the long-run impacts are fully worked out in a comparatively short time, with the longest time lapse covering about four quarters.

Conclusions and Forecasts for Last Two Quarters of 1972

The model for forecasting consumer price indexes for food was constructed to utilize information on farm level prices and food marketing wages to forecast the price level for food. To achieve this objective, the equation system utilized both recursive and simultaneous relationships to analytically describe the differences in the markets for crop foods and livestock food products. Since this system contains exogenous coefficients with opposite signs in the farm value and farm-retail spread equations, it has some built-in stabilizers. If the farm value forecast is too high, there is increased downward pressure on the farm-retail spread forecasts, and vice versa. This system results in a model which forecasts the consumer price index for food at

home and for all food with an acceptable degree of accuracy.

Forecasts for the last two quarters of 1972, based on forecasts of the exogenous variables as of July 1972, are shown in table 6. Utilizing the actual values for the CPI for food categories for 1972 I and II, the model forecast an annual increase for 1972 of 4.8 percent in the consumer price index for food at home and 4.6 percent in the consumer price index for all food. The official forecasts relied heavily on this type of information but were tempered to some extent by judgment of commodity specialists and others in the Department of Agriculture.

Table 6.—Forecasts of indexes for 1972
(1967 = 100)

Item	Third quarter	Fourth quarter
Farm value:		
FVL	132.7	125.9
FVC	116.4	111.7
Farm-retail spread:		
FRSL	123.3	130.8
FRSC	120.3	120.2
CPI for food at home	123.5	124.2
CPI for all food	125.3	126.2

Writing and the Economic Researcher

By Ronald L. Mighell and Elizabeth Lane¹

Writing is a working tool for the economist—a tool both for doing research and for presenting research results. Effective writing is important for all scientists, but especially for economists. Economists need to write well to complete their work effectively, to meet their ethical obligations, and to advance their own welfare.

Key words: Writing; communication; language; research tool.

Writing has been termed "visible thinking." Certainly writing leaves a living record that exposes thinking to view. It is a way of communicating with other times and places.

This paper is concerned with the use of writing on the part of those engaged in research and especially economic research. Such writing should reflect the underlying logic of research. It should be balanced and judicial, not an advocate's brief, but a search for truth.

The conscious use of language to find truth traces back at least to the Greek philosophers. The Socratic method, for example, asks searching questions on all sides of a problem in the hope that the answers may lead to truth. John Locke in 17th century England came close to the modern view in his "Essay Concerning Human Understanding" (5). This essay was really a report on the use of words as tools of investigation and action, an inquiry into what the human mind can know and cannot know. Locke thought a word properly used should "excite in the hearer the same idea which it stands for in the speaker" and that words to properly convey ideas should be "as near as may be to such ideas as common usage has annexed to them."

Good writing in any field is effective writing. As Susan Stebbing once put it, "a word is a tool only in so far as it is used in a context by someone who has some purpose in view. Whether, therefore, we are using language well or badly depends upon the purpose for which we use it" (11). Obviously, effective writing may have different purposes, some quite different from the one that concerns us here. Writing has been used for purposes of persuasion to specific courses of action. One of the present writers once heard former Governor James Curley of Massachusetts deliver a street corner address that was one of the most moving and persuasive

that could be imagined. This was speaking rather than writing and an important element in this politician's charm was the warmth of his personal delivery. But persuasive writing may be equally effective.

Economists Need to Write Well

Effective writing is important to all scientists because a research project is never complete until the final report is published. But writing is doubly important to economists. It is important not only at the end, but in the beginning and in the middle of a research enterprise. It contains a large part of the thinking that guides the research economist through the whole maze of his analysis. Economics is both less tangible and less exact than the physical and biological sciences. Measurements are frequently difficult and logic forms a greater part of the whole process. "Logical reasoning is the key to success in the mastery of basic economic principles, and shrewd weighing of empirical evidence is the key to success in application" (9).

C. P. Snow, the British novelist-scientist, has called attention to the lack of communication between scientists and nonscientists in his phrase, "the two cultures." As science becomes more complex the comprehension of the ordinary citizen is baffled. The scientific world seems to be receding from his ken at an alarming rate, an expanding universe indeed (10).

The very nature of economics places an extra ethical burden on economists to use writing even more effectively than other scientists. Economics deals with the most efficient use of resources, and writing is one of the leading resources of the economist. The results of economic research in agriculture, for example, are intended to be put to practical use by farmers, businessmen, and others who work directly or indirectly with farmers. How well they are put to use may depend on how well the findings are presented. A farmer quickly grasps the meaning of an improved genetic strain of

¹For an earlier treatment of the same theme see the paper by Esther M. Colvin and Ronald L. Mighell (1). Italic numbers in parentheses indicate items in the References, p. 20.

corn. But he needs more time to understand the economic effects of a new method of vertical coordination. If economic results are not clearly presented, the value of the research may be lost entirely.

The economist deals with what Alfred Marshall called "the study of mankind in the ordinary business of life" (6). Whatever he writes must be clear to the man who is doing this ordinary business. If the economist does not write clearly he will not be understood or listened to. Worse still, the ideas he is trying to advance may be scorned and receive less favorable attention than if he had not written at all.

Writing and Professional Standing

Economists need to write well, not only to report their work but also to establish and maintain their own professional standing. In other callings, there are more obvious ways to gain recognition. The engineer has the working model, the artist the great painting, the geneticist the improved variety, the geographer the new discovery. The research economist must look to his written report as the tangible evidence of his accomplishment.

The younger research economist needs to write effectively to become favorably known. His writing may be the only available basis for measuring his output. It will be used by his peers and by his supervisors in appraising the quality of his work and in rating him for promotion or for selection for specific assignments. The older economist must continue to write effectively to maintain his research standing. And he who becomes an administrator has a special need to present ideas effectively.

A moderate but sustained volume of writing of high quality is likely to be the most productive. We all know individuals who turn out many mediocre reports. This may be evidence of expendable energy, but if the work is carelessly done the results may be of dubious value. The harm done by faulty conclusions can be very great. Witness the often quoted statement of Keynes about the ideas of statesmen "emanating from some economist good or ill of a preceding generation."

Economists then need to write well to complete their work effectively, to meet their ethical obligations, and to advance their own welfare. Properly understood, these objectives are reinforcing and not conflicting.

Writing as a Research Tool

The foregoing discussion suggests some of the reasons why writing is a research tool. Writing is the means by which we report research findings and complete the

research task. But it is more. It is the working record of a project from the first note to the final report. It goes through each phase of the analysis to the last commentary that may follow. Project statements, program reports, current memoranda, correspondence, research notes, and other records, all constitute writing. Each serves a particular purpose, temporary or more lasting. Some writing is for internal use, just notes for the eye of the researcher only; other writing is for the use of immediate colleagues, and final writing is for publication. Even the writing the researcher does for himself is an integral part of the thinking about the problem before him. It is like talking out loud to oneself, an extension of the mental processes in which all aspects and all possibilities are examined and reexamined. Nearly all such writing should be discarded as soon as it has served its purpose. You will understand why if you have ever tried to read a manuscript in which the writer has been unable to eliminate his notebook from the final draft. Such writing includes all the false starts, the dead ends, the mistakes, the wrong theories, the partial answers that were an essential part of the research pilgrim's progress, but which need to be put aside and forgotten once the correct way has been found and illuminated.

What Makes Good Writing?

Good writing is that which serves the particular purpose most effectively. Note writing may be trim and short, no more than a memory jogger, if that is all you need to communicate with your future self. Instruction-book writing makes good use of brief, direct descriptions of essential points. Novels must appeal to the prospective reader or they will not be read. Even research reports had better not be dull if one expects them to reach their intended audience.

Style is an essential part of good writing. Each writer develops his own style. The best advice on how to do this usually contains a number of *do's* and *don't's*. The first *do* is to read other good writers and see how they engage the interest of their readers. Another *do* is the good advice to use short, simple words. But this doesn't mean that longer words are not to be used at all. They are sometimes the most effective. E. B. White's story about the calculating machine is an indication of the problem:

A publisher in Chicago has sent us a pocket calculating machine by which we may test our writing to see whether it is intelligible. . . . The machine (it is simply a celluloid card with a dial) is called the Reading-Ease Calculator and shows four grades of "reading ease"—Very Easy, Easy, Hard, and Very Hard. You count your words and syllables, set the dial, and an indicator lets

you know whether anybody is going to understand what you have written. An instruction book came with it, and after mastering the simple rules we lost no time in running a test on the instruction book itself, to see how *that* writer was doing. The poor fellow! His leading essay, the one on the front cover, tested Very Hard (14).

A few economists have been charged with bringing economics down to the level of comprehension of the common man and making the subject interesting. For example, some professional eyebrows may have risen to all-time highs at Samuelson's statement in the preface to the seventh edition of his "Economics" that:

No effort is spared to help you understand and enjoy economics. Each chapter is carefully planned. Each has a comprehensive summary. Color has been planned, behind the scenes, for optimal learning. Key definitions are indented in brown for emphasis and new concepts in figures and tables usually appear in green to alert the reader.

Samuelson's attention to these details and the general quality of his writing made his book one of the most widely used college texts in economics and did not prevent him from receiving a Nobel award.

Despite the reputation of fostering a dismal science, the writings of the early classical economists were often entertaining. No one who has read Adam Smith's description of the operations in a pin factory can deny its compelling and effective style. Thomas Malthus has been much maligned but there is no doubt that his writing attracted attention.

Consider the following brief passages from three current economists. Each sets a stage for your attention.

Is our marketing machinery too complicated? . . . This may seem complicated and mysterious. It is complicated, but it need not be mysterious. A watch is a complicated mechanism, but there is no great mystery about it. Few would object because a modern watch is more complicated than an hourglass or than a sundial—at least not if the watch runs well. Nor should we object to a complicated system of marketing if the parts are well coordinated (13).

Economics has always been partly a vehicle for the ruling ideology of each period as well as partly a method of scientific investigation. . . . So economics limps along with one foot in untested hypotheses and the other in untestable slogans. Here our task is to sort out as best we may this mixture of ideology and science. We shall find no neat answers to the questions it raises. The leading characteristic of the ideology that dominates our society today is its extreme confusion. To understand it means only to reveal its contradictions (8).

There is no more pleasant fiction than that technical change is the product of the matchless ingenuity of the small man forced by competition to employ his wits to better his neighbor. Unhappily, it is a fiction. Technical development has long since become the preserve of the scientist and the engineer. Most of

the cheap and simple inventions have, to put it bluntly, been made. Not only is development now sophisticated and costly but it must be on a sufficient scale so that successes and failures will in some measure average out. Few can afford it if they must expect all projects to pay off. This was not the case in the late eighteenth and the nineteenth century. Then, in the beginning stages of the applications of science and technology to industry and agriculture, there was scope for the uncomplicated ingenuities of a Hargreaves or a Franklin (3).

Notice how each passage arouses interest. The first one uses a simple analogy to clarify what might have been a dry technical discussion. The second sets out the kernel of the writer's philosophy about what economics is. The third one uncovers a "pleasant fiction" about technical change that forms the basis of an argument about current capitalism.

Planning Your Report

Suppose that you, an economist, have completed a study and are about to write your final report. You have done the analysis, you are thoroughly acquainted with your material, you are enthusiastic about it, you now wish to communicate the results to a wider audience. The first thing is to decide who that audience is. Are you writing for your professional colleagues? For farmers? For businessmen? For whom? This decision will determine much of what you are to include in the report. If you write for professional people the style can be more formal and technical. But if you expect farmers to read the report, it must be presented in straightforward, clear style, free from technical terminology.

A good way to begin working is to make a general outline, listing main headings and subheadings. An outline is not a sacred plan, but one subject to change as you go along.

The *organization* of your final report will depend on whether it is to be a journal article, a bulletin, or a book. It may start with a preface or foreword with acknowledgments and follow with the central contents, a summary, and conclusion. A few pages of introduction to give the setting and background of the problem may be helpful. The central contents will be most effective if marked with suitable headings for the pertinent parts.

Authors of reports directed to an audience of nonspecialists need to use special care in preparing prefaces, tables of contents, and summaries or abstracts. Some readers rely on these parts to give them a basis for deciding whether to read long reports.

Some short reports and journal articles do not need a formal preface. But readers need to know why the study was made and perhaps how it is related to other studies. Acknowledgment of assistance is sometimes desirable also. Material of this sort, which is not actually part of

the research but which helps readers to see the whole picture, is often best presented in a preface.

The headings that compose a table of contents are essentially an outline of the report. Use enough headings to make an informative table of contents (but not so many that your narrative seems discontinuous). A table of contents can be a help to an author as well as to readers. While your report is in manuscript form, the contents page will show you at a glance whether the organization is logical.

The summary should begin with your principal conclusion. If you found, say, that a new practice will reduce the cost of marketing certain commodities, let that be your opening paragraph. Then summarize your supporting data. Include background and research method only if the summary is not clear and self-contained without them.

It might seem reasonable that your summary should describe events in the sequence in which they occurred—beginning perhaps with a bit of history, proceeding through what you did, and ending with what you learned. Research tends to be inductive in its procedure and is all too likely to be tedious and uninteresting to nonspecialists. If you adopt such a leisurely pace, therefore, you could lose your readers. Some of them, of course, are already interested in the subject and will stay with you to the end, no matter how you present your material. It is the other readers—those who are not yet interested but who would be, if they knew what you are going to tell them about—who need your special consideration.

To this end, you need to keep details to a minimum, emphasize the significant findings, and suggest some of the important deductions that flow from them. Good research reporting really establishes effective communication through two stages, roughly corresponding to the inductive and deductive kinds of reasoning.

Standards of Style

Style in writing is of two kinds. There is first the individual style of the writer, which we have already mentioned. This consists of all those special characteristics that set his writing apart and make it interesting or not.

The second is the kind of style reflected in the rules of each publishing house or agency. These rules of style may seem arbitrary but they serve a useful purpose in providing uniformity and consistency. They are conventions that improve communication just as traffic rules improve the flow of traffic.

Some of the items covered by such rules are spelling, word usage, tables and charts, and footnotes.

(1) *Spelling.* Economists like other scientists are expected to use accepted spellings of both common and scientific terms. Any fall from grace in this respect is likely to affect the reception of the message. The reader unconsciously responds adversely and wonders whether the writer who cannot spell really knows his special subject. If the economist writes: "The *concensus* was..." the reader may conclude that there is little *consensus* about it.

Some words are spelled in more than one way. Accepted spellings usually mean those that are preferred by your publisher. In the U.S. Department of Agriculture, we follow the Government Printing Office Style Manual or one of the leading dictionaries if the Manual does not show the word. Each State agricultural experiment station, each journal, and each publishing house has some preferences that it follows.

(2) *Statistical tables and charts.* A good picture may be worth 10,000 words, but a bad picture is worth hardly anything. Thus amended, the proverb is especially applicable when the "picture" is a chart in a research report.

Economists are necessarily skilled at interpreting difficult analytical charts, and they sometimes forget that readers of their reports may not be so skilled. As a result, they occasionally illustrate their reports with charts that defy comprehension.

Few readers are willing to put great effort into understanding a chart. If it remains a puzzle after a few moments' contemplation, most readers will give it up and turn the page. Some people dislike all charts, but even those who don't object to charts can be defeated by a bad one. The purpose of a chart is to help readers grasp the situation quickly. A chart should never be more difficult than the reading matter it is supposed to clarify.

Tables and charts can follow more than one style, but there should be uniformity within each publication. Look at a current copy of the U.S. Department of Agriculture's annual "Agricultural Statistics." You will find one general style for table titles, boxheads, stubs, and data presentations. The U.S. Department of Commerce follows another style in its annual "Statistical Abstract of the United States." Both use some of the general guidelines of the GPO Style Manual. Agriculture Handbook 433, "Preparing Statistical Tables," is a useful reference for tablemaking economists and statisticians (12).

The annual "Handbook of Agricultural Charts" issued for the agricultural outlook meetings illustrates one style for charts.

Various conventions develop in different fields. In economics, for example, we learn to draw a demand schedule (or supply schedule) with price on the vertical

axis and quantity on the horizontal axis. We do this because Alfred Marshall did so. But in statistics, we do it the other way around, because the early American statisticians adopted the convention of placing the dependent variable on the vertical scale.

(3) *Reference notes.* Footnotes and citations bother many writers and readers. Some readers go berserk and would banish all footnotes. It is best in popular writing to keep them to a minimum. In professional writing, some footnotes and references are essential for well-rounded discussion and for acknowledgment of sources. However, as one editor put it, it is not necessary to take in each other's washing nor to seek excessive support for a point that is generally accepted. As a working rule, put most footnote material in the main text if it is needed or leave it out unless very essential.

References to publications need special attention. Whether to place them in footnotes or in a reference list may be a matter of preference. But accurate checking of details is imperative. Nothing is more discouraging than tracing a scrambled reference.

(4) *Punctuation.* Proper punctuation is desirable, but sentences that depend too much on punctuation may easily go astray. Try to construct sentences that will take the least punctuation. They will be better because they will be less involved and will carry your message more directly. When in doubt consult one of the handbooks such as the Macmillan Handbook of English (4).

(5) *Word usage.* It is said that a straight line is the shortest distance between two points. In the choice of words, the word that goes to the target is the straight word with the clear meaning. In terms of sentences and paragraphs, it is the straight construction and the correct idiom. If someone says it is a clear morning with a sunny prospect, you know what he means. But if he says the day breaks on an uninhibited atmospheric condition with a prospective outlook for full-scale illumination, you may be perplexed.

Economists sometimes overwork certain words. One of the current vogue words is *aggregate*. There seems to be a feeling that it is more professional to say *aggregate* than *total*, *whole*, or some other shorter and more euphonious synonym. The shock value of using such a word on special occasions is largely lost if it is used all the time.

The same reasoning applies to superlatives, adjectives, and adverbs. They should be used sparingly. If you overstress every point, your reader will pay no attention when you have something that really deserves stress.

A special problem for economists in discussions of future events is the tendency to overqualify. The future is uncertain. No one wishes to be caught out on a limb that may break. But it is better to state your assump-

tions and make forthright statements than to hedge and lose all meaning. Take this statement in the November 1966 Demand and Price Situation: "The value of final goods and services produced in 1966 will likely be slightly more than 8½ percent above the 1965 level. . ."

This is fussy-fuzzy. Why not just say: "The value of goods and services produced in 1966 will be about 8½ percent above the 1965 level."

The following from the February 1972 Demand and Price Situation is more direct and interesting and conveys more information: "The economy made a significant though incomplete recovery in 1971 from its 1969-70 mini-recession. Real output rose approximately 2½ percent. . ."

Conclusion

We have talked about why economists need to write well, how writing serves as a research tool as well as a way of presenting research results, and how it relates to professional standing.

We have outlined some of the elements of good writing and standards of style. And finally we have considered how to go about report writing. Some of the steps in doing a report may be listed briefly:

1. Have something worth writing about.
2. Know your material.
3. Define your audience.
4. Choose the appropriate form and outlet: journal article, technical bulletin, popular release, etc.
5. Lay out the general organization of your report, listing significant headings.
6. Write a preliminary draft and rewrite several times.
7. Have your colleagues review the draft.
8. Write a final draft.

If research results are to have their greatest value, a report must not only be written; it must be read. Other things being equal, the reports most likely to be read are those which are written as simply and clearly as possible without loss of accuracy. Many factors enter into the production of a high quality report; a writer who resolves to spare his readers unnecessary difficulty has made an excellent beginning.

Writers' Guides

A number of handbooks, dictionaries, and other guides for writers are available. This selected list may help. Some have been mentioned earlier; others could be added.

U.S. Government Printing Office Style Manual. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., January 1967 (or later revision).

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The Macmillan Handbook of English. By John M. Kierzek and Walker Gibson. Fifth ed., Macmillan, New York, 1965.

American Usage: The Consensus. By Roy H. Copperud. Van Nostrand Reinhold, New York, 1970.

The Elements of Style. By William Strunk, Jr., ed. by E. B. White. Second ed., Macmillan, New York, 1972.

The Careful Writer: A Modern Guide to English Usage. By Theodore M. Bernstein. Atheneum, New York, 1965.

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BOOK REVIEWS

Behavioral Change in Agriculture—Concepts and Strategies for Influencing Transition

Edited by J. Paul Leagans and Charles P. Loomis. Cornell University Press, Ithaca, N.Y. 14850. 506 pages. 1971. \$12.50.

The thread tying together the diverse presentations in this symposium is the concept of the change agent system and the change target system. The change agent is the person or organization attempting to introduce or effect a change; the target is the group or individual at which the change is aimed. The problem is how to establish linkage between these two in the context of a total social system.

An effective extension education system is described by one author as but one requisite of agricultural modernization, whose "specific role is to orchestrate physical, biological, technological, economic, social, and political resources so as to reduce dissonance between the status quo and desirable new economic and social conditions."

The place of agricultural development in the total national economy is discussed. Three broad categories of activities and influences required for agricultural development, as seen by one writer, are farming itself, agri-support activities, and agri-climate, involving many people besides farm operators or even rural people as a whole. In this view, a single approach to the problem of accelerating agricultural expansion and development is not adequate. It is considered a "systems problem," one with many facets, multiple complementarities, essential requisites and sequences, and many feedbacks. Another view, looking at the components of innovation, modernization, and change, states the central question as: What kind of people with what kinds of habits are engaged in agriculture, and what, if anything, can change how many of their habits at what speed?

A writer who says that the concept of agricultural development makes sense only if it is understood as part of a concept of national development also says it is an integral part of a national process of economic transformation and growth. This is essentially a revolutionary process of social change, implying new social, economic, and political processes, new institutional structures, and changed relationships among social groups, especially those regulating the distribution and uses of wealth, power, and status.

Several papers focus on the importance of freedom of choice for farmers and others and of the national will to develop. If it is accepted that peasant farmers act in an economically rational manner, more than economic analysis is needed to bring about behavioral change in agricultural development. Theoretical formulations must include institutional factors such as major reforms and correlative shifts in power, the role of education and public administration, the strategic influence of transport facilities, and social overhead capital.

The central issue from the perspective of economics is the establishment in an underdeveloped country of an environment conducive to achieving the behavioral patterns required by modern agriculture. This is the achievement of a system of agricultural economy with the capacity to support development, using the potentialities of science, technology, division of labor, exchange, and investment. When these development functions are converted to behavioral functions, we have investors, entrepreneurs, laborers, marketing agents, consumers, public officials, and civil servants.

The issue of behavioral change in agricultural development must take into account the need to modify the antecedent system of the developing country and the consequences of the choices made about the nature of the system. Since the services and functions of the state are so crucial in national economic development, agriculture cannot be developed very far until the state becomes a stable and serviceable institution.

Concerning developmental administration, attention is given to types of control and aspects of power. Overall administrative problems are complex in developing societies because the various historic types of control are barely integrated. The most critical problem in analyzing power relations is locating and measuring it—who has it, over whom, of what kind, and how much. Various systems of measuring power include use of such indicators as wealth, status, and formal authority; tracing the decisionmaking process; employing a sociometric picture of the power structure of a unit or the concept of a power base.

A caveat by one author is that consultants cannot assume, on the word of the national leadership, that policies that would be feasible in their own countries are acceptable in another society. The ultimate target of government agricultural policy in the underdeveloped

countries is the majority of its own citizens, who must be led, aided, and motivated to make choices favorable to their national goals. Developmental administration and agricultural economies are finding a need to be as experimental and creative in adapting their own scientific roles as they expect central and local governments, the private sector, and farmers to be in confronting the demands of modernization.

In the study of society, sociologists tend to use one of two approaches: study of processes (forms of interaction) or study of social systems (component groups and their subsystems). While not rejecting these styles of inquiry, one author suggests social relationship as the analytic unit because of its specificity and because as a model, the analyst can elaborate it toward social action or the social systems level. Changes occurring in the relationships among groups and the various subsystems of society, based on the social relationship paradigm, provide systematic indexes of societal change. Development is thus viewed as a process, of which societal change is an important ingredient.

It is further pointed out that the analysis of social relationships in the context of social systems is useful because it places the relationships in their structural setting; permits inventorying related social relationships in a systematic frame of reference; and helps make judgments about the relative importance of the various relationships involved in making specific behavioral changes. However, the author says that better concepts are needed to systematically analyze development phenomena over time and across national boundaries.

The strategy for introducing innovations in developing countries, from the viewpoint of social psychology, involves introduction by the change agent of new concepts and new connections among concepts, but must also weaken connections of certain concepts to each other. In other words, a farmer must unlearn some things as well as learn new ones, which may cause some anxiety and disorientation. The writer says efforts should be made in the direction of adapting innovations to the subjective culture, personality, and social system of farmers.

A respondent on the matter of concepts in the social sciences says that the building of concepts is good, and their elaboration is necessary for discipline building, but probably not for developmental change. Needed are developmental change concepts from sociology and social psychology that the change agent can incorporate into his developmental skill and that will increase his creativity. He will then shape his tools to the extent that he understands the concepts and how to use them.

In a paper on the social sciences, the author says that the concept of the social system enables the analytical

observer to move from a given subsystem to the larger system and back again, whether these systems are change agent, change target, or any other system. Elements of the social system described are status role, rank accorded by the system, power or capacity to control others' beliefs or sentiments, or other means used within the system to attain the members' ends. The norms of the social system are rules prescribing what is acceptable or nonacceptable. The end, goal, or objective is another element of the social system and represents the change (or retention of the status quo) that members of the system expect to accomplish through appropriate interaction. Ends must become motivating forces within the change targets, so the actors can more effectively satisfy their physiological, social, and moral needs, thus activating self-fulfillment. Policy and strategy must deal with all sectors of the total system and its subsystems that affect the producer.

Referring more specifically to the agricultural sciences, another author emphasizes the need for an interdisciplinary approach in developing countries, a theme which runs throughout this book. He says, in its earliest stages, all science had practical purposes, but pure science is now rated higher. This has led to greater specialization and fragmentation, making synthesis more difficult and an interdisciplinary approach more essential in both pure and applied science, and especially in agriculture. In planned and directed agricultural change, innovations must be supported by change in the economic, social, legal, and political fields as well. Indeed, changing agriculture in developing countries is often a matter of changing the very structure of society itself.

This reviewer has not done justice to the substantial contributions in this book, since it was possible only to touch on some of the highlights. The editors have done a useful service to readers with introductions to the various sections, and the last chapter contains an excellent résumé. For its many insights, the book should be "must" reading in the field of foreign technical assistance.

Helen W. Johnson

Farming and Food Supply: The Interdependence of Countryside and Town

By Sir Joseph Hutchinson. Cambridge University Press, 32 East 57th Street, New York 10002. 146 pages. 1972. \$11.

A view frequently expressed nowadays is that agriculture is a declining industry whose impact on society is rapidly lessening. The author believes otherwise and

presents a thesis to show that agriculture has been an essential element in urban growth and has always made impressive achievements in promoting human welfare. The rising standard of living is largely attributable to the ability of agriculture, because of the benefits from increased technology, to depend on fewer farmers to produce more, thus channeling much manpower into the industrial sector.

The author, Sir Joseph Hutchinson, is a noted British agriculturist and the book is an elaboration of a series of lectures on comparative agriculture given at Cambridge University.

The lectures are an extensive documentation of the historical evolution and development of agricultural systems. As agriculture spread throughout the world, farming communities grew in diverse locations. The history of agriculture shows the ability of agrarian development to adapt to local circumstances and the interactions between agriculture and other sectors of the economy. Consequently there is an interdependence between farming and industry. In essence, the relationship between rural and urban occupations is one of complementarity and mutual stimulus.

The application of technology to agriculture was greatly accelerated by the industrial revolution. The pattern of modern agriculture, to a great degree, is the consequence of the demands on agriculture of an increasingly urban society, and the technological inputs that urban society makes possible.

The author uses excellent examples to denote diversities in agrarian development. Britain, India, and sub-Saharan Africa illustrate contrasting stages of change and different rates of development. The book therefore would be profitable to persons interested in studying stages of economic growth.

Jack Ben-Rubin

Water Rights Laws in the Nineteen Western States

By Wells A. Hutchins. Completed by Harold H. Ellis and J. Peter DeBaal. Volume I. U.S. Department of Agriculture, Miscellaneous Publication No. 1206. U.S. Government Printing Office, Washington, D.C. 20402. 650 pages. 1971. \$4.

When Wells A. Hutchins died on September 19, 1970, he left unfinished a manuscript of a three-volume expansion of his "Selected Problems in the Law of Water Rights in the West," which was published in 1942. Two of his colleagues in the U.S. Department of Agriculture

completed the manuscript, and the volume under review is the first of the three volumes to appear in print.

This volume follows the pattern of the earlier authoritative treatises on water rights by Clesson S. Kinney and Samuel C. Wiel and concentrates on those of the Western States, with the addition of a description of the water rights laws of Alaska and Hawaii. It differs in this respect from the more comprehensive, multivolume "Water and Water Rights," now being published under the editorship of Robert Emmet Clark of the University of Arizona. This companion treatise includes Eastern water law as well as Western.

Volume I of "Water Rights Laws in the Nineteen Western States" is organized somewhat differently from the "Selected Problems." Its nine chapters deal in succession with State water policies; classification, definition, and description of available water supplies; characteristics of watercourse; navigable waters; property nature of water and water rights; water rights systems pertaining to watercourses; appropriation of water; appropriative right and the exercise of the appropriative right. Like its predecessor, it is problem centered, functional rather than expository.

Considerable space is devoted to a description of the riparian and appropriation doctrines. In considering the origin of the former, the author notes that the contention of an American genesis advanced by Wiel has been challenged, but he does not choose sides. In reviewing the controversial origins of the appropriation doctrine he is more positive; he concludes that the California miners played a major role, that the contributions of the Spanish antecedents in the Southwest are "questionable," and those of the Mormons in Utah minimal.

One-third of the treatise is devoted to a consideration of the nature of the appropriative property right and the manner of its exercise. Hutchins emphasizes its measure, beneficial uses, alienation, and the relative rights of senior and junior appropriators. Nor does he neglect problems arising from the conveyance of water in natural channels, rotation in the use of water, and changes in point of diversion.

Succeeding volumes will treat ground-water rights, the adjudication and administration of the appropriative right, the pueblo water right, the ancient Hawaiian water rights, Federal-State relations, interstate dimensions of water rights, and the international law affecting water rights.

When completed, these three volumes will become the standard legal reference devoted exclusively to the laws governing the use of water in the 19 Western States.

Robert G. Dunbar

By Julian Bharier. Oxford University Press, 417 5th Avenue, New York 10016. 314 pages. \$9.

Anyone who musters the courage and energy to undertake a study of a country's total economy over a span of its most significant economic development—in this instance, ranging over two-thirds of this century—deserves praise. Anyone who has done such a remarkable job of research and of assembling so many figures, and assessing their value and accuracy, deserves double praise. Julian Bharier, lecturer in economics at the University of Durham, has done such a job.

The book is divided into four parts. Part 1 discusses the economy of Iran as of 1900; part 2, consisting of five chapters, deals with the human resources, Iran's economic structure and growth up to 1970, its fiscal and monetary policies, the State and development, and Iran's foreign trade and balance of payments. The third part consists of six chapters which cover agriculture, forestry, and fishing; mining and the oil industry; manufacturing and industry; transport and communications; other infrastructure sectors; and banking and services. The last part is devoted to projections of the economy in the 1970's. A substantial bibliography is included.

The author uses and analyzes material dating from as far back as the late 19th century.

The work shows that there is much statistical material available on Iran. While much of it is open to question, it is there and even if not all accurate, at least it offers a trend.

The author has done such a thorough job that he even informs us that "in Teheran there was only one car in 1910 and not more than ten in 1920." The work is heavily footnoted, which is helpful to a reader who wants to seriously explore a particular aspect of the Iranian economy. There are many statistical tables and charts which permit quick reference to detail on the subject the author is discussing. In addition, he tells us of the reliability of the tables.

Iran has changed much during the last 70 years. Particularly significant is that at the turn of the century, agriculture contributed 80 to 90 percent of the GNP. During the 1930's and 1940's, the share was reduced to 50 percent and now it is under 20 percent. Conversely, mining (including oil) and manufacturing, which were insignificant in 1900, contributed about 40 percent to GNP in 1970, with the major percentage increases occurring since 1950.

Since the end of World War II, the service sector—which includes agriculture, mining, and manufacturing—expanded from contributing 10 to 20 percent of GNP to

about 50 percent. This growth resulted from the fact that such services as banking and insurance, power supply, telephone communication, and a series of other private and public services, were insignificant with respect to GNP at the turn of the century, but had become very substantial by the late 1940's.

With regard to these changes, the author states that "from a traditional agricultural status, Iran has therefore been transformed into one in which no single sector has great predominance over the others." This is interesting inasmuch as most of us think about Iran only in terms of oil. And certainly, the dominance of oil in the export field is absolute.

The author also states that as the importance of agriculture in the economy declined, so did the unequal distribution of income. And as the land reform program came into being—in the 1960's—and industry expanded, a broadening band of middle-income earners was created. This suggests to Bharier that income in Iran is now more evenly distributed than in 1960. But this is difficult to prove since there are no adequate income statistics. There is little question that the land reform was a political success and the economy has shifted away from agriculture, but the income gap between the well-off and the poor has probably not narrowed and it may even have grown wider.

Iran has come a long way in its development since 1900. Yet, real development has only taken place within the last 15 years, largely because of oil revenues but also because of the land reform which has helped move Iranian agriculture forward, although not as much as hoped and planned for.

The question for Iran in the 1970's and beyond is whether the rich get richer and the poor get poorer. Much of the progress that has taken place in Iran has benefited the "haves." This of course is true not only for Iran but for most developing nations and, on second thought, for the developed nations as well.

Like other countries possessing an exhaustible product—oil—Iran must look to a future without this commodity. Natural gas is an alternative which apparently Iran has much of. But in the very long run, Iran (and all oil-producing countries) must find and develop alternatives to continue its economic life. The country needs to build its industry and agriculture and the infrastructure that goes with these enterprises. Iran seems to be well on its way toward that undertaking.

It can be concluded from this work that the major progress in Iran during the recent past has come about with the strong hand of the Shah. This progress has not come easily, and certainly has taken place at some cost. An assassinated prime minister, attempts on the Shah's

life, and guerrilla activities are only some of the reactions to the push forward by Iran. But the economy is getting stronger and the GNP continues to make substantial gains, second only to Japan's. With this progress, Iran has become an attractive country for outside investment and Japan, the United States, and European countries are taking advantage of this situation. At the same time, Iran is emerging as a powerful force in the Middle East and is moving toward the goal of reestablishing some of the greatness of its long and rich past.

Michael E. Kurtzig

What's Wrong With Economics?

By Benjamin Ward. Basic Books, 10 East 53rd St., New York 10022, 273 pages. 1972. \$695.

Economists have failed to integrate their microeconomic and macroeconomic theories in any effective manner.

Economists have failed to develop any satisfactory theory of imperfect competition compatible with a general equilibrium framework. They have no scientifically acceptable method of appraising the interaction of large-scale economic organizations with the rest of the environment.

Economists have failed to adequately account for the costs of making decisions in their theories. By and large, the impact of information, knowledge, and understanding on the economic process has been disregarded.

Economists have failed to recognize some of the limitations of mathematical economics. There seems to be an upper bound to the productivity of added data in improving the quality of econometric studies. This limit seems to be at a level of accomplishment not much better than that reached by a well-informed intuitive observer. The quality of many mathematical economic studies has been defined in terms of mathematical instead of economic standards, thereby raising questions of scientific relevance. Mathematical economics has been theorem seeking rather than truth seeking.

Economists have failed to make much progress in handling externalities. The interaction of economic with noneconomic variables has received minimal attention.

Economists have failed to recognize the restrictive nature of their marginalist orientation. They are primarily concerned with the preservation of the basic structure of society and with the process of control and adjustment of that society. Even if economics is the most highly developed policy science, the insistence on scientific procedures ensures that to study any dramatic change in society is unscientific.

Economists have failed to rid themselves of the myth of economics as a value-neutral science.

Economists have failed to develop a plausible decision model. Their decision models are seriously flawed because an interaction occurs between the decision criteria and the alternative choices during the decision process. This results in a high degree of interdependence among decisions. For example, the recognized phenomena of changes in preferences, attitudes, and values and such social factors as interpersonal utility comparisons have not been integrated in consumer decision theory.

Economists (neoclassical economists) have failed to incorporate the problem of income distribution into their theory. They "remain uneasily silent, fearing to transcend on the one hand the positivist norm of avoiding value-judgements, and unable on the other to think of anything interesting of a 'positive' nature to say" (p. 49).

These are some of the things Ward says are wrong with economics. The approach of the book is much more general than just the simple listing of the failings of economics. He starts with a broad outline of the development of neoclassical economics as a science. Ward shows that economics passes Kuhn's tests for the existence of a normally developing science. Economics researchers are widely scattered but form a cohesive unit based on common interests, shared commitments, and frequent interaction. They are concerned with solving problems about the behavior of nature, but typically work on problems of detail. Economists are in general agreement as to what problems are suitable for research and what general form the solution should take. Only the judgment of colleagues is accepted as relevant for defining both problems and solutions. On these grounds, economics can be classed a science.

Within this framework of a science, certain characteristics have caused economics to develop along a sharply restricted path. Economic scientists are concerned with a set of "puzzles"—problems of detail. In solving these puzzles, great use is made of "stylized facts." These are false or at least exaggerated assumptions about some of the facts of the situation being studied that are designed to direct attention away from some facts and onto others.

While economists are concerned with issues of the day, their insistence on framing these issues into this puzzle-stylized fact framework causes the issues orientation to lose relevance. This, coupled with the underlying value system economists have in common and the constraints imposed by power in the normal social science system and its environment, substantially reduces economics' importance to society.

Ward feels this positivistic, scientific orientation of economics is wrong. By our narrow focus, we have taken

the wrong path. We must break from the bounds of a positivist methodology and recognize the fiction of value neutrality. We must recognize the Velikovskyan nature of our world. It is continually changing and any attempt to find underlying laws of behavior is bound to fail. We must study the process of change rather than some sort of static norm. The emphasis of economics as a social science should be placed on social rather than science. By emphasizing science over social, we are moving down a blind alley. We need to recognize the artisan nature of economics.

No concrete solutions are offered to the problems of economics in Ward's book. The emphasis is on what we as economists ought not to do. But, as he indicates, the first step in correcting any error is recognizing that that error does exist. For this I think Ward can be commended. We do need reminding.

His positive recommendations can be summarized by the statement, "Look elsewhere." Economics should be less inner-directed. Other professions, particularly other social sciences, have much to contribute to the study of economic issues. We have much to learn from such areas as philosophy, psychology, history, communications, linguistics, and even Marxist economics. The problems, not puzzles, of economics need to be reformulated. Only by doing this is there hope for providing any basis for the development of theory to a point where formal empirical research can be expected to yield much fruit.

In reading this book, most will find arguments with which they disagree. But on more reflection I believe they will agree that the issues raised by Ward are important to the profession. In fact, most may agree

with his recommendations for change. Agree in general, that is. The problem lies in implementing his suggestions.

They may not agree, however, with his somewhat pessimistic view of the value of economics as it is defined today. While the profession has a positivistic, quantitative, scientific bent today, I believe this is tempered by a good deal of pragmatism. It works. Maybe it is not the best. Maybe it is not the most efficient. But useful results are produced. If the economics profession is viewed as a young, immature, but growing profession on the road to maturity, I believe one will feel that it is not on the wrong road as Ward thinks; but it is plotting a sometimes erratic path down the rather wide, but correct, road.

If one views Ward's thesis as a directive to take bigger steps in a straighter line, I agree. But the profession is like a baby that still crawls. Walking is faster but we don't know how yet. So we keep crawling. And we should. But Ward is right in that we should not lose sight of the fact that we must try to do better. Even while crawling, we must spend some of our effort in learning to walk. This type of problem is the real danger economics faces. We must not forget that learning to walk is more important in the long run than crawling another 10 feet.

Ward's book is well worth reading because of its cogent, often lucid, commentary on the state of the art. His often wry and witty insight alone, whether one agrees or disagrees with his arguments, makes this book a pleasure to read.

William E. Kost



Suggestions for Submitting Manuscripts for Agricultural Economics Research

Each contributor can expedite reviewing and printing his paper by doing these things:

1. **SOURCE.** Indicate in a memorandum how the material submitted is related to the economic research program of the U.S. Department of Agriculture and its cooperating agencies. State your own connection with the program.

2. **CLEARANCE.** Obtain any approval required in your own agency before sending your manuscript to one of the editors or assistant editors of Agricultural Economics Research.

3. **ABSTRACT.** Include an abstract when you submit your article. The abstract should not exceed 100 words.

4. **NUMBER OF COPIES.** Submit one ribbon copy and two additional good copies of the article for review.

5. **TYPING.** Double space everything, including abstract and footnotes.

6. **FOOTNOTES.** Number consecutively throughout the paper.

7. **REFERENCES.** Check all references carefully for accuracy and completeness.

8. **CHARTS.** Use charts sparingly for best effect. Include with each chart a page giving essential data for replotting.

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